SCIENTIFIC RESEARCH NEEDS

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MINISTRY OF THE ENVIRONMENT

ONTARIO

March 1984

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HAZARDOUS CONTAMINANTS
AND STANDARDS BRANCH
135 ST. CLAIR AVENUE WEST
TORONTO, ONTARIO M4V 1P5

Date Due

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SCIENTIFIC RESEARCH NEEDS

MINISTRY OF THE ENVIRONMENT

ONTARIO

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POLICY & PLANNING BRANCH

Research Coordination Office

HAZARDOUS CONTAMINANTS
AND STANDARDS BRANCH
135 ST. CLAIR AVENUE WEST
TORONTO, ONTARIO M4V 1P5

3/4/84

This summary of research needs of the Ontario Ministry of the Environment has been prepared to assist university researchers interested in submitting requests for fiancial grants in support of environmental research.

The needs are classified into four Research Categories: Air, Water, Liquid and Solid Waste, and Analytical Method Development, and are listed in order of priority within each category.

Applicants are advised that proposals submitted will be evaluated, not only on scientific merit, but also on ability to meet the Ministry research needs according to their priorities as indicated. Any single research need may generate more than one project.

The selection process will be subject to availability of funds. The procedure is part of the Ministry's new process of Research Planning which has been designed to:

- ensure that research is consistent with MOE goals;
- set up procedures for management and coordination of research activities;
- evaluate research performance; and
- ensure that research results are publicized and new technology is put to use.

The Research Planning Process will be conducted annually through a number of matrix-oriented working groups with responsibility for:

- development of research needs and priorities;
- development of specific research requirements based on the identified priority needs;
- technical evaluation of research proposals and project performance; and
- making recommendations for use of new technical developments.

For further information, please direct your enquiries to:

Research Coordination Office
Policy and Planning Branch
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Tel: (416) 965-5788

MOE RESEARCH NEEDS - MARCH 1984

PRIORITY	AIR POLLUTION	WATER POLLUTION	LIQUID AND SOLID WASTE	ANALYTICAL METHODS
1 Issue/ Subject	Hazard and risk due to airborne contaminants.	Lack of information on the biological response to contamination from industrial and municipal discharges.	Leachate collection, control and treatment technologies.	Broad spectrum screening Methods for contaminants in drinking, surface, and waste waters.
Type of Research Needed	- Studies (including short-term tests) of contaminant effects on receptors, humans, mammals, vegetation/soils, and/or biological systems. - Development of novel methods of collating and displaying hazardous contaminants information.	- in situ and ecosystem indicators of water quality impairment. - development of predictive toxicological-dose response relationships for populations/communities of aquatic organisms based on contaminant structure. - mutagenic and carcinogenic testing related to human risk (ref. Need No. 7 Anal.)	- measurement of leakage by-passing tile system (field study) - efficiency of purge well - leakage through earth liners - assessment of leachate leakage from secure landfills	Development of: - ICP - MS - GC - Microwave Plasma Emission Spectrometry - Ion specific mass detector and other broad-spectrum screening tools - Biological on-line monitoring

MOE RESEARCH NEEDS - MARCH 1984

PRIORITY	AIR POLLUTION	WATER POLLUTION	LIQUID AND SOLID WASTE	ANALYTICAL METHODS
2 Issue/ Subject	Relationship between inhalable particulate and effects on human health.	Standard protocol for prediction of fate and removability of hazardous organic compounds in municipal Water Pollution Control Plants.	Destruction of municipal and indistrial wastes by incineration.	Determination of organic vapours in air samples.
Type of Research Needed	- Examination of effects of inhalable particulate on human health for application to standard setting, e.g. blood lead, respiratory function, etc.	Use of model compound behaviours to determine fate and treatability of other compounds. What means can be effectively used to predict fate and treatability of waste water.	- Improvements to state-of-the-art technology - Field and laboratory studies.	Broad spectrum screening methods to extend the range of compounds currently monitored and to provide a more rapid and cost effective approach to analysis of organic air pollutants. Improved specificity, speed and cost of analytical methods.

MOE RESEARCH NEEDS - MARCH 1984

PRIORITY	AIR POLLUTION	WATER POLLUTION	LIQUID AND SOLID WASTE	ANALYTICAL METHODS
3 Issue/ Subject	Improvement of routine, non-routine, and mobile monitoring techniques.	Removal capabilities of treatment techniques for specific trace contaminants in drinking water.	Indications of long-term degradation of solidified encapsulated fixed waste. Long-term impact on waste site is difficult to decide based on simple leachate extraction tests.	Development and validation of sampling protocols for contaminants in surface and drinking waters.
Type of Research Needed	- Further development of mobile monitoring analytical methods for an increased number of compounds and validate methods. - Rugged, simple, field monitoring technicques for a variety of organic and inorganic compounds. - Passive sampling techniques.	Evaluate effectiveness of resin absorption, reverse osmosis, aeration, and biological filtration as treatment processes for hazardous contaminant removal.	- Long-term integrity of solidified waste	To determine significance of sampling protocols on analytical data. Protocols should also consider microbiological parameters other than the standard coliforms etc.

MOE RESEARCH NEEDS - MARCH 1984

PRIORITY	AIR POLLUTION	WATER POLLUTION	LIQUID AND SOLID WASTE	ANALYTICAL METHODS
4 Issue/ Subject	Development of long-range and meso-scale atmospheric transport modelling to predict the impact of pollutants on receptors, and assess contributions of different sources to air pollution problems.	Insufficient data available on the persistence and migration of select hazardous contaminants in soil and groundwater.	Landfill cover infiltration and effects on: - leachate production and waste decomposition	Investigation and development of laboratory techniques to assess leaching potential of specific wastes for hazardous waste classification.
Type of Research Needed	- Further model development	Laboratory and field tests of half-life and migration of various hazardous contaminants in soil and groundwater conditions in Ontario, including synergistic effects.	- Field measurements using developed instruments.	- Serial leaching of specific wastes to determine the effect on contaminant concentration. - Development of a simplified procedure to determine the effect of long term (serial) leaching. - Review of parameters such as pH, time, oxygen, liquid to solids ratio, etc. to improve the ability of the procedure to approximate actual site conditions.

MOE RESEARCH NEEDS - MARCH 1984

PRIORITY	AIR POLLUTION	WATER POLLUTION	LIQUID AND SOLID WASTE	ANALYTICAL METHODS
5 Issue/ Subject	Improvement of methods of risk assessment in connection with air pollution.	Paucity of epidemiological information relating pathogens and their effects on humans and other animals by ingestion and by other means (e.g. recreational).	Suitability of backfilling (inert) waste. Difficulties in allowing certain wastes to be used for construction purposes.	PAH analysis for air and air particulates.
Type of Research Needed	- Development of methodology for risk assessment due to air pollutant exposure.	a. Relationships between indicator organisms and human epidemiology. b. Resistance of specific pathogens to disinfection practices in drinking and waste water treatment plants. c. What represents an effective dose of major waterborne pathogens on humans? d. Impact of pathogens on aquatic and domestic animals.	- Criteria for use in construction applications.	- Development of broad spectrum screening methods to extend the range of PAHs currently monitored with emphasis on specificity. - Development of cost-effective analytical methods for PAH's.

MOE RESEARCH NEEDS - MARCH 1984

PRIORITY	AIR POLLUTION	WATER POLLUTION	LIQUID AND SOLID WASTE	ANALYTICAL METHODS
6 Issue/ Subject	Effects in Ontario of sulphur and nitrogen compounds and acids transported in the atmosphere.	The impacts of in-place pollutants in sediments on the aquatic ecosystem and human health.	Development of a method to assess methane flux in landfill. Development of guidelines for the management of gas migration.	Analysis of hazardous chemicals in complex industrial wastes.
Type of Research Needed	- Further work to increase our understanding of Atmospheric Chemistry and deposition, e.g. studies of chemical reactions in clouds, studies of ozone formation around industrial areas in Ontario, wet and dry deposition measurements.	1. Measurements of uptake by and release from sediments of trace organics (esp. PAH). 2. Transformation of trace organics in sediments. 3. Availability of trace organics and heavy metals in sediments to biota. 4. Measurement and modelling of sediment resuspension and redistribution due to wave action, storms and currents.	Specific measurements of ventilation rates and flux.	Development of analytical methods must be developed for contaminants listed in Table 1 of the Interim Hazardous Waste Guideline and for the priority list prepared by the Hazardous Contaminants and Standards Branch.

MOE RESEARCH NEEDS - MARCH 1984

PRIORITY	AIR POLLUTION	WATER POLLUTION	LIQUID AND SOLID WASTE	ANALYTICAL METHODS
7 Issue/ Subject	Assessment of human exposure to selected contaminants using data from fixed central monitoring stations.	Natural occurrence of some inorganic contaminants (e.g. certain metals, fluorides, radioactive materials) in surface and ground waters.	Impact on groundwater from chemical spills and spill clean-up technology.	Genotoxicity testing
Type of Research Needed	- More sensitive personal dosimeters need to be developed for a variety of contaminants. - To examine relationships between fixed central stations measurements and human health effects.	Determine sources and availability of trace metals, fluoride, radon, from specific geological formations, e.g. limestone, igneous rocks.	- State-of-the-art reviews - Case histories	- In-situ test systems needed to identify the presence of genotoxic compounds or conditions (mixture effects) in the environment. - Screening tests that can be quickly and economically carried out on environmental samples are required for laboratory application. - Relationships need to be developed between carcinogenicity and genotoxicity test response and human health effects.

MOE RESEARCH NEEDS - MARCH 1984

PRIORITY	AIR POLLUTION	WATER POLLUTION	LIQUID AND SOLID WASTE	ANALYTICAL METHODS
8 Issue/ Subject	Insufficient information on the sources and fate of hazardous contaminants.	Information is needed on impact of assigning levels of suspended solids, sediment and nutrients on stream use.	Accumulation of non-degradable contaminants on land (inorganics and organics)	Biological toxicity testing
Type of Research Needed	- Determination of hazardous contaminants sources, source strengths, sink mechanisms and strengths, atmospheric persistence and fate.	Case studies of streams to assess impacts of siltation and nutrients on stream ecology, recreational potential and fishery resources.	- Establish criteria for defining acceptable levels. - Develop remedial (resoration) methods.	- Standardized on-site integrative biological tests to identify potential problem areas in air, soil and water. - Development of laboratory protocols for recovery, identification, and enumeration of pathogenic organisms (virus, bacteria, protozoa) - Field methods for pre-concentration of viruses

MOE RESEARCH NEEDS - MARCH 1984

PRIORITY	AIR POLLUTION	WATER POLLUTION	LIQUID AND SOLID WASTE	ANALYTICAL METHODS
9				
Issue/ Subject	Improvement of current sampling methods for volatile metals and organometallics in ambient air.	Impact of organic compounds in pulp and paper discharges on fish and fish consumption.	Environmental and health implications from burning of railway ties.	Surrogate parameters for water monitoring.
Type of Research Needed	- Sampling methodology needs development and validation.	- Developmental work required to identify and quantify compounds of significance, followed by assessment of effects on fish.	Identify and quantify emissions.	Development and improvement of detection limits of surrogate parameters and correlation with specific and group toxic compounds in drinking and waste waters.

MOE RESEARCH NEEDS - MARCH 1984

PRIORITY	AIR POLLUTION	WATER POLLUTION	LIQUID AND SOLID WASTE	ANALYTICAL METHODS
10 Issue/ Subject	Stack and emission sampling is extremely expensive.	Identification of Klebsiella pneumoniae and other micro-organisms in pulp and paper mill effluent and other carbo-hydrate rich effluents and their possible impact on human health.		Analytical standards.
Type of Research Needed	Development of: - More specific, low cost sampling and analysis protocols. - Continuous monitoring methods - Total reduced sulphur calibration method	To identify the various species of Klebsiella in pulp and paper effluents, to quantify their numbers, and to determine their impact on human health and life stock.		Synthesis, quantification and validation of standard reference compounds such as dioxins, furans, PAH's as required for MOE laboratories and not available commercially.

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PRIORITY	AIR POLLUTION	WATER POLLUTION	LIQUID AND SOLID WASTE	ANALYTICAL METHODS
11 Issue/ Subject	Real time monitoring of toxic airborne substances. Sufficient sensitivity for trace airborne contaminants.	Optimization of remedial measures to minimize the agricultural impact on water quality.		Development of resin samplers for preconcentration of low levels of toxic contaminants in surface and drinking waters prior to analysis.
Type of Research Needed	- Dioxin and other compounds sampling techniques need development	Detailed evaluation of specific structural, tillage and cropping practices, i.e. environmental and cost-benefit studies including energy use		- XAD and similar resin technology need to be extended and tested for a comprehensive range of trace organics. Rugged high flow field sampling systems need to be developed. - Evaluation of the capacity of resin system to recover total organic loading from waters and waste waters.

MOE RESEARCH NEEDS - MARCH 1984

PRIORITY	AIR POLLUTION	WATER POLLUTION	LIQUID AND SOLID WASTE	ANALYTICAL METHODS
12 Issue/ Subject	Correlation of monitoring data related to specific pollution sources.	The quantity and types of hazardous contaminants leached from plastic pipes and other compounds, coating etc., in contact is not well defined.		Non-separative analytical methods for air analysis.
Type of Research Needed	- Application of receptor modelling techniques to some specific situations in Ontario to evaluate this methodology. - Development of methods to characterize emission sources in a way useful for receptor modelling.	To investigate potential trace contaminant leachates from piping, coatings and other material in contact with potable water.		Rapid, specific, non-separative analytical methods need development. Tiered analytical systems of increasing resolution and sensitivity need further work.

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PRIORITY	AIR POLLUTION	WATER POLLUTION	LIQUID AND SOLID WASTE	ANALYTICAL METHODS
13 Isse/ Subject	Deposition and accumulation of airborne compounds.	The impact of agricultural tile drainage on aquatic systems.		Tiered testing of groundwater for landfill investigations.
Type of Research Needed	- Deposition monitoring technology needs further development - Pathways of contaminants to fruits and vegetables via soil or air should be studied with respect to mercury, lead, boron, nickel, etc.	- To evaluate nutrients and solids transport under varying cropping and tillage conditions. - Study of the effects of tile drainage and open ditches on peak flows and dry weather flows.		- Development of a tiered testing protocol for groundwater contaminant analysis.

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PRIORITY	AIR POLLUTION	WATER POLLUTION	LIQUID AND SOLID WASTE	ANALYTICAL METHODS
14				
Issue/ Subject	Uncertainty in calculating toxic compound concentrations downwind of emergency sites.			On-site sampling of gaseous emissions.
Type of Research Needed	- Comparison and validation of different models. - Effect of local topography on dispersion.			Further development of air sampling methods for both on and off-site measurements. Development of simple, rugged field analytical methods for landfill air contaminants emissions.

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PRIORITY	AIR POLLUTION	WATER POLLUTION	LIQUID AND SOLID WASTE	ANALYTICAL METHODS
15	Formation, decay and reaction mechanisms of many primary and secondary pollutants.			
Issue/ Subject				
Type of Research Needed	- Study of intermediates in pollutant reactions; modelling of Atmospheric Chemistry including hazardous contaminants.			

MOE RESEARCH NEEDS - MARCH 1984

PRIORITY	AIR POLLUTION	WATER POLLUTION	LIQUID AND SOLID WASTE	ANALYTICAL METHODS
16 Issue/ Subject	Relationship between indoor and outdoor air contaminants.			
Type of Research Needed	- Indoor air concentrations of different pollutants need to be assessed together with their relationship to outdoor measurements and the implications for abatement action based on outdoor measurements of selected contaminants.			

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PRIORITY	AIR POLLUTION	WATER POLLUTION	LIQUID AND SOLID WASTE	ANALYTICAL METHODS
17 Issue/ Subject	Effects of accumulation of various pollutants, e.g. on vegetation, short or long-term.			
Type of Research Needed	- Establishment of dose response data for the effect of pollutants, e.g. ethylene, arsenic, nickel, SO_2, O_3, fluorides on different species. - Determination of long-term health effects.			

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PRIORITY	AIR POLLUTION	WATER POLLUTION	LIQUID AND SOLID WASTE	ANALYTICAL METHODS
18 Issue/ Subject	Uncontrolled or inefficient processes may produce unwanted air emissions.			
Type of Research Needed	- Determination of most efficient generic processes for selected industries or plants, e.g. pulp and paper, some municipal incinerators.			

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PRIORITY	AIR POLLUTION	WATER POLLUTION	LIQUID AND SOLID WASTE	ANALYTICAL METHODS
19 Issue/ Subject	Dispersion from non-standard sources (e.g. mine tailings, fugitive emissions).			
Type of Research Needed	- Dispersion modelling for non-standard sources needs further development.			

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